Fourth Generation Versatile Interface Processor (VIP4) Installation and Configuration Guide

Product Numbers: VIP4-50=, VIP4-80=, MEM-VIP4-64M-SD=, MEM-VIP4-128M-SD=, MEM-VIP4-256M-SD=

Introduction

This guide provides instructions for installing, configuring, and maintaining the fourth-generation Versatile Interface Processor (VIP4). The VIP4 operates with the Cisco 7505, Cisco 7507, Cisco 7507-MX, Cisco 7513, Cisco 7513-MX, and the Cisco 7576 routers with the Route Switch Processor (RSP1, RSP2, RSP4, RSP4+, or RSP8), and with the Cisco 7000 series routers using the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI). See the "Software Requirements" section on page 9 for specific compatibility requirements.

The VIP4 supports online insertion and removal (OIR), which allows you to remove and replace a VIP4 without first shutting down the system. Online insertion and removal maximizes router availability by letting you add or remove VIP4s during system operation. See the "Guidelines for VIP4 Removal and Installation" section on page 15 for more information on removing and installing the VIP4.

The VIP4 supports LAN and WAN port adapters (PAs), including Fast Ethernet, T1/E1, High-Speed Serial Interface (HSSI), T3/E3, T3/E3 ATM, multichannel T1/E1, multichannel T3/E3, OC-3 ATM, Packet over SONET (POS), and OC-12 ATM. For a list of supported port adapters, refer to the "VIP4 and Port Adapter Compatibility" section on page 7.

The VIP4 port adapters do not support OIR, so when removing or inserting a port adapter, the system must be shut down first. The VIP42 must be removed from its interface processor slot before removing or installing a port adapter.

For complete descriptions of interface subcommands and the configuration options available for VIP4-related interfaces, refer to the configuration note for each of the port adapters installed on your VIP4 and to the appropriate Cisco IOS software configuration publications. (See the "Related Documentation" section on page 2.)

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Related Documentation

Your router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- Cisco IOS software:

  For configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com. Translated documentation is available at the following URL:http://www.cisco.com/public/countries_languages.shtml.

- Cisco 7000 series routers:

  For hardware installation and maintenance information on the Cisco 7000 series routers, refer to the *Cisco 7000 Hardware Installation and Maintenance* manual that shipped with your router.

- Cisco 7500 series routers:

  For hardware installation and maintenance information on the Cisco 7500 series routers, refer to the *Cisco 7500 Installation and Configuration Guide* that shipped with your router.

- For international agency compliance, safety, and statutory information for WAN interfaces:
  - *Site Preparation and Safety Guide*
  - *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers*
  - *Regulatory Compliance and Safety Information for the Cisco 7000 Series Routers*

- Port adapters/interface processors/service adapters:

  For port adapter information and maintenance information, refer to the specific port adapter installation and configuration guide. See the port adapter index online at http://www.cisco.com/univercd/cc/td/doc/product/core/cis7505/portadpt/index.htm.

- To view Cisco documentation or obtain general information about the documentation, refer to the following sources:
  - "World Wide Web" section on page 40
  - "Documentation CD-ROM" section on page 40
  - "Obtaining Technical Assistance" section on page 41

VIP4 Overview

This section describes the VIP4 and discusses VIP4-specific features and functions, such as:

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- How to Identify the VIP4 Model, page 3
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What is the VIP4?

The VIP4 is the fourth generation of Versatile Interface Processors for use with Cisco 7500 or Cisco 7000 series routers. The VIP4 installs in any interface processor slot on your router, as noted below:

- Slots 0, 1, 2, 3, or 4 in the Cisco 7000 router
- Slots 0, 1, or 2 in the Cisco 7010 router
- Slots 0, 1, 2, or 3 of the Cisco 7505 router
- Slots 0, 1, 4, 5, or 6 of the Cisco 7507 router
- Slots 0, 1, 2, 3, 4, or 5, and 8, 9, 10, 11, or 12 of the Cisco 7513 router
- Slots 0, 1, 2, 3, 4, or 5 of Router A, and slots 8, 9, 10, 11, or 12 of Router B in the Cisco 7576 router

For more information on interface processor slots on your router, refer to the *Cisco 7500 Series Installation and Configuration Guide* or the appropriate Quick Start Guide for the Cisco 7500 series routers, or refer to *Cisco 7000 Hardware Installation and Maintenance* manual for the Cisco 7000 series routers.

How to Identify the VIP4 Model

There are two different versions of the VIP4: the VIP4-50 and the VIP4-80. Both VIP4 versions support two single-width port adapters or one dual-width port adapter and identical ECC-protected memory expansion options. Each VIP4 operates with the Cisco 7505, Cisco 7507, Cisco 7507-MX, Cisco 7513, Cisco 7513-MX, and the Cisco 7576 routers.

Using the **show diag** command, you can distinguish between the VIP4-50 and VIP4-80, as indicated in the following example, and in Table 1.

Table 1 Distinguishing the VIP4 Models

EEPROM contents (hex) Value	VIP4 Model
0x31	VIP4-50
0x22	VIP4-80

In the example below, the VIP is a VIP4-80:

```
Router# show diag 1
Slot 1:
        Physical slot 1, ~physical slot 0xE, logical slot 1, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status:None
        EEPROM format version 1
        VIP4-80 RM7000 controller, HW rev 2.01, board revision A0
        Serial number:14773010  Part number:73-3143-02
        Test history:0x00        RMA number:00-00-00
        Flags:cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20:01 22 02 01 00 E1 6B 12 49 0C 47 02 00 00 00 00
          0x30:50 06 00 00 00 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags:0x4      Insertion time:0x5168 (2w1d ago)

        Controller Memory Size:64 MBytes CPU SDRAM, 64 MBytes Packet
SDRAM

        PA Bay 0 Information:
                Fast-Ethernet PA, 1 ports, 100BaseTX-ISL
                EEPROM format version 1
                HW rev 1.00, Board revision A0
                Serial number:03536381  Part number:73-1688-03

        PA Bay 1 Information:
                Dual Port Fast Ethernet (RJ45), 2 ports
                EEPROM format version 4
                HW rev 1.00, Board revision 04
                Serial number:MIC043929WV  Part number:73-5419-03

        --Boot log begin--

Cisco Internetwork Operating System Software
IOS (tm) VIP Software (SVIP-DW-M), Version 12.0(16.5)S, EARLY DEPLOYMENT
MAINTENANCE INTERIM SOFTWARE
TAC Support:http://www.cisco.com/cgi-bin/ibld/view.pl?i=support
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Thu 29-Mar-01 16:33 by ninahung
Image text-base:0x60010938, data-base:0x60340000


        --Boot log end--
```

Table 2 outlines features of the VIP4 models, and Table 3 provides a list of the VIP4 internal components.

Note You can use any combination of available CPU memory configurations and packet memory configurations on the VIP4. You do not need to have equal amounts of CPU memory and packet memory installed. (For information about upgrading memory, see the "Upgrading VIP4 Memory" section on page 31.)

Table 2 VIP4 Model Features

Product	Packets Forwarding (PPS)[1]	Bandwidth	Distributed Switching/ Services (DSW)	Usage
VIP4-50	~140,000	750+ MB	Yes; Moderate to high DSW	Distributed switching Moderate link utilization Cisco Express Forwarding (CEF)
VIP4-80	~170,000	750+ MB	Yes; Very high DSW	High distributed switching performance Multiple high-speed PAs with high link utilization Extensive use of distributed IP services Cisco Content Networking (CCN)

1. PPS = Packets per Second

Table 3 VIP4 Internal Components

Type	Size/Speed	Description	Location (see Figure 1)
CPU (for VIP4-50)	200 megahertz (MHz) internal operating frequency	Reduced Instruction Set Computer (RISC), IPSR5271 processor	CPU
CPU (for VIP4-80)	250 megahertz (MHz) internal operating frequency	Reduced Instruction Set Computer (RISC), MIPS R7000 processor	CPU
SDRAM DIMMs [1] (program or CPU memory)	64 (default), 128, or 256 MB	100-MHz synchronous dynamic random-access memory (SDRAM) as CPU memory contained on dual in-line memory modules (DIMMs)	U1
SDRAM DIMMs [1] (packet memory)	64 MB	100-MHz synchronous dynamic random-access memory (SDRAM) as packet memory contained on dual in-line memory modules (DIMMs)	U5

1. 8-bit error correction code (ECC), rather than byte parity, for single error-bit correction and double error-bit detection

Specifications

The VIP4 physical specifications are listed in Table 4.

Table 4 VIP4 Specifications

Description	Specifications
Physical dimensions	The VIP4 occupies one chassis slot and can only be operated in a Cisco 7500 series, or Cisco 7000 series routers using the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI)
Shipping weight	5 lb (2.25 kg)
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	-4 to 149°F (-20 to 65°C)

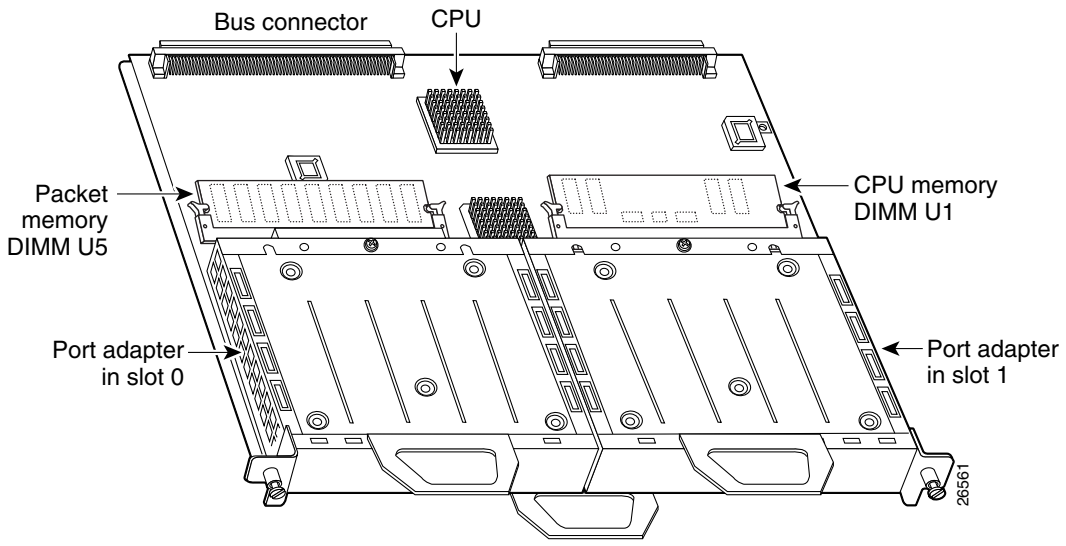
VIP4 Port Adapter Overview

The VIP4, a single motherboard, supports up to two single-width port adapters, or one dual-width port adapter. Figure 1 shows a VIP4 with two installed single-width port adapters. A dual-width port adapter occupies both port adapter slots (not shown).

Note To ensure proper airflow in the router and compliance with EMI prevention standards, a VIP4 with one single-width port adapter must have a blank port adapter installed in the empty port adapter slot location.

Note A VIP4 without at least one installed port adapter is not supported.

Figure 1 VIP4 with Two Single-Width Port Adapters—Horizontal Orientation Shown



VIP4 and Port Adapter Compatibility

For more information on the available port adapters supported by the VIP4, refer to the *Cisco Product Catalog* online, or contact a Cisco sales representative in your area. For more information on a specific port adapter, refer to the specific port adapter installation and configuration guide. The port adapters, including part numbers for ordering, are listed in the *Cisco Port Adapter Documentation* flyer. This document is available online at http://www.cisco.com/univercd/cc/td/doc/product/core/12939paf.htm or in print (DOC-7812939).

Note The VIP4 does not support the PA-GE. However, the VIP4-80 supports the Enhanced Gigabit Ethernet Interface Processor (GEIP+), an assembly consisting of a VIP4-80 with a permanently attached dual-width Enhanced Gigabit Ethernet port adapter.

Table 5 identifies the port adapters supported by the VIP4 at the time of this writing, and Table 6 identifies the interface processors and service adapters that are supported by the VIP4.

Note The following table does not address which software release applies to the VIP6-80 port adapters. For more information, refer to the Software Advisor at http://www.cisco.com/cgi-bin/Support/CompNav/Index.pl.

Table 5 List of Port Adapters Supported by VIP4

Product Number	Description	Number of Ports	Single/Dual Width
PA-A3-T3	ATM DS3 port adapter, enhanced	1	Single
PA-A3-E3	ATM E3 port adapter, enhanced	1	Single
PA-A3-8T1IMA	ATM inverse multiplexer over ATM port adapter	8	Single
PA-A3-8E1IMA	ATM inverse multiplexer over ATM port adapter	8	Single
PA-A3-OC3MM	ATM OC-3c/STM-1 multimode, enhanced	1	Single
PA-A3-OC3SMI	ATM OC-3c/STM-1 single-mode (IR), enhanced	1	Single
PA-A3-OC3SML	ATM OC-3c/STM-1 single-mode (LR), enhanced	1	Single
PA-A3-OC12-MM	ATM OC-12/STM-4 single-mode (IR); multimode	1	Dual
PA-A3-OC12-SMI	ATM OC-12/STM-4 single-mode (IR); multimode	1	Dual
PA-POS-OC3- MM	Single-wide OC-3c/STM-1	1	Single
PA-POS-OC3- SMI	Single-wide OC-3c/STM-1	1	Single
PA-POS-OC3- SML	Single-wide OC-3c/STM-1	1	Single
PA-A1-OC3SM	ATM OC3 Single-Mode Intermediate Reach	1	Single
PA-A1-OC3MM	ATM OC3 Multimode	1	Single
PA-FE-TX	Fast Ethernet 100BaseTX	1	Single
PA-FE-FX	Fast Ethernet 100BaseFX	1	Single
PA-2FE-TX	Dual-Port Fast Ethernet 100BaseTX	2	Single
PA-2FE-FX	Dual-Port Fast Ethernet 100BaseFX	2	Single
PA-4E	Ethernet 10BaseT	4	Single

Table 5 List of Port Adapters Supported by VIP4 (continued)

Product Number	Description	Number of Ports	Single/Dual Width
PA-8E	Ethernet 10BaseT	8	Single
PA-F-MM	FDDI Multimode	1	Single
PA-F-SM	FDDI Single-Mode	1	Single
PA-FD-MM	FDDI Full Duplex Multimode	1	Single
PA-FD-SM	FDDI Full Duplex Single-mode	1	Single
PA-4T+	Serial, Enhanced	4	Single
PA-8T-V35	Serial, V.35	8	Single
PA-8T-232	Serial, RS232	8	Single
PA-8T-X21	Serial, X.21	8	Single
PA-T3/PA-T3+	T3 Serial Interface/T3 Serial Interface enhanced	1	Single
PA-2T3/ PA-2T3+	T3 Serial Interface/T3 Serial Interface enhanced	2	Single
PA-E3	E3 Serial Interface	1	Single
PA-2E3	E3 Serial Interface	2	Single
PA-4E1G/75	E1 G.703 Serial (75 ohm/Unbalanced)	4	Single
PA-4E1G/120	E1 G.703 Serial (120 ohm/Balanced)	4	Single
PA-MC-T3	Multichannel T3	1	Single
PA-MC-E3	Multichannel E3	1	Single
PA-MC-2T1	Multichannel DS1/PRI T1 (100 ohm)	2	Single
PA-MC-4T1	Multichannel DS1/PRI T1 (100 ohm)	4	Single
PA-MC-8T1	Multichannel DS1/PRI T1 (100 ohm)	8	Single
PA-MC-2T3+	Multichannel with two T3 interfaces	2	Single
PA-MC-8DSX1	Multichannel DS1/PRI T1 (100 ohm)	8	Single
PA-MC-2E1/120	Multichannel E1 with G.703 120-ohm interface	2	Single
PA-MC-8E1/120	Multichannel E1 with G.703 120-ohm interface	8	Single
PA-MC-STM-1MM	Multichannel STM-1 Port Adapter	1	Single
PA-MC-STM-1SMI [1]	Multichannel STM-1 Port Adapter	1	Single
PA-H	HSSI	1	Single
PA-2H	HSSI	2	Single
PA-VXC-2TE1	High-Capacity Digital Voice	2	Single
PA-VXC-2TE1+	High-Capacity Digital Voice	2	Single
PA-VXB-2TE1	Moderate-Capacity Digital Voice	2	Single
PA-VXB-2TE1+	Moderate-Capacity Digital Voice	2	Single
PA-SRP-OC12MM [2]	Multimode fiber	2	Dual
PA-SRP-OC12SMI [2]	Single-mode fiber, intermediate reach	2	Dual

Table 5 List of Port Adapters Supported by VIP4 (continued)

Product Number	Description	Number of Ports	Single/Dual Width
PA-SRP-OC12SML [2]	Single-mode fiber, long reach	2	Dual
PA-SRP-OC12SMX [2]	Single-mode fiber, extended reach	2	Dual

1. Supported on VIP4-80 only.
2. Requires Cisco IOS release 12.1(12)E or later, or Cisco IOS release 12.1(21)S or later.

Table 6 List of Interface Processors Supported by VIP4

Product Number	Description	Number of Ports
GEIP	Gigabit Ethernet Interface Processor	1
GEIP+	Gigabit Ethernet Interface Processor, enhanced	1

Note All interface processors are dual-width.

Installation Prerequisites

This section provides installation prerequisites to ensure a successful VIP4 installation, and includes the following sections:

- Software Requirements, page 9
- Hardware Requirements, page 10
- Microcode Overview, page 10
- ROM Monitor Overview, page 11
- Tools and Parts Required, page 11

Software Requirements

The minimum Cisco IOS Release requirements for VIP4-50 and VIP4-80 are listed in Table 7. For configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

Table 7 VIP4 Minimum Software Release Requirements

VIP Release	Minimum Cisco IOS Supported Releases
VIP4-50	Cisco IOS Release 12.0(13)S2 or later release of Cisco IOS Release 12.0 S Cisco IOS Release 12.1(6) or later release of Cisco IOS Release 12.1 mainline Cisco IOS Release 12.1(5)E or later release of Cisco IOS Release 12.1 E Cisco IOS Release 12.1(5.3)T or later release of Cisco IOS Release 12.1 T Cisco IOS Release 12.2(1) or later release of Cisco IOS Release 12.2 mainline Cisco IOS Release 12.2(1)T or later release of Cisco IOS Release 12.2 T
VIP4-80	Cisco IOS Release 12.0(10)S1 or later release of Cisco IOS Release 12.0 S Cisco IOS Release 12.1(3) or later release of Cisco IOS Release 12.1 mainline Cisco IOS Release 12.1(3)E or later release of Cisco IOS Release 12.1 E Cisco IOS Release 12.1(3)T or later release of Cisco IOS Release 12.1 T Cisco IOS Release 12.2(1) or later release of Cisco IOS Release 12.2 mainline Cisco IOS Release 12.2(1)T or later release of Cisco IOS Release 12.2 T

Traffic Management

- Simple Network Management Protocol (SNMP) agent V1 (RFCs 1155-1157)
- Management Information Base (MIB) II (RFC 1213)

Hardware Requirements

The VIP4 is a single motherboard. It operates with:

- Cisco 7505, Cisco 7507, Cisco 7507-MX, Cisco 7513, Cisco 7513-MX, and the Cisco 7576 routers with the Route Switch Processor (RSP1, RSP2, RSP4, RSP4+, or RSP8); the RSP should have at least 64 MB of DRAM.
- Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI), the RSP7000 should have at least 64 MB of DRAM.
- Two single-width port adapters, or one dual-width port adapter, supporting multiple LAN and WAN port adapter types, including Ethernet, Fast Ethernet, Gigabit Ethernet, serial, channelized serial, multichannel, HSSI, ATM, and POS.

Note The VIP4 requires at least one port adapter installed in order to be supported. A single-width port adapter must have a blank port adapter installed in the empty port adapter slot location.

Microcode Overview

The VIP4 microcode (firmware) is an image that provides card-specific software instructions. A programmable read-only memory (PROM) device on the VIP4 contains a default microcode boot image that assists the system in finding and loading the microcode image from the Cisco IOS bundle or Flash memory. The router supports downloadable microcode, which enables you to upgrade microcode versions by downloading new microcode images, storing them in system Flash memory, and instructing the system to load its image from Flash memory. You can store multiple images for an interface type and, with a configuration command, instruct the system to load any one of them or the default microcode image.

The microcode boot image in the PROM initializes the VIP4 and then assists downloading the VIP4 microcode image. All interfaces of the same type (VIP4, and so on) will load the same microcode image, either from the microcode image bundled with the Cisco IOS or from an image stored in system Flash memory. Although multiple microcode versions for a specific interface type can be stored concurrently in Flash memory, only one image can load at startup.

The **show controllers cbus** command displays the currently loaded and running microcode version for each interface processor and VIP4. The **show startup-config** EXEC command shows the current system instructions for loading microcode at startup.

Software and interface processor microcode images are carefully optimized and bundled to work together. Overriding the bundle can result in system incompatibilities. We recommend that you use the microcode included in the software bundle. For a complete description of microcode and downloading procedures, refer to the "Upgrading VIP4 Microcode" section on page 28.

ROM Monitor Overview

The VIP4 read-only memory (ROM) monitor, known as Rommon, is firmware. It runs a brief set of system diagnostics, initializes the VIP4 hardware, and downloads a copy of the Cisco IOS image.The ROM monitor loads the Cisco IOS image from Flash memory or from a TFTP server. While multiple Cisco IOS images can be stored in RSP Flash memory, just one can be loaded at system startup.

The VIP4 ROM monitor functions similarly to the boot loader image on the RSP, which runs a copy of the Cisco IOS image. The boot loader image allows the router to access the Cisco IOS image when powering up or initializing the system.

Tools and Parts Required

You need the following tools and parts to install or upgrade a VIP4:

- Number 1 Phillips and a 3/16-inch flat-blade screwdriver
- ESD-prevention equipment or disposable grounding wrist strap, included with all Cisco products
- VIP4 (For specific compatibility requirements, see the "Software Requirements" section on page 9.)

Note The VIP4 requires at least one port adapter installed in order to be supported. A single-width port adapter must have a blank port adapter installed in the empty port adapter slot location.

If you need additional equipment, contact a service representative for ordering information.

Agency Approvals

The VIP4 is designed to comply with and meet the following agency approvals:

Approvals	Agencies
Safety	CSA-C22.2 No. 950 (Canada) EN60950 (Europe) IEC 950 (International) UL 1950 (United States)
Emissions	CE marking (Europe) CISPR 22 Class B (International) FCC Part 15 Class A (United States) EN55022 Class B (Europe) ICES-003 Class A (Canada) VCCI Class B (Japan)

Safety Guidelines

Following are safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

Safety Warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, may harm you. A warning symbol precedes each warning statement.

Warning **This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.**

Waarschuwing **Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.**

Varoitus **Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä julkaisussa esiintyvien varoitusten käännökset löydät laitteen mukana olevasta *Regulatory Compliance and Safety Information* -kirjasesta (määräysten noudattaminen ja tietoa turvallisuudesta).**

Attention **Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez le document *Regulatory Compliance and Safety Information* (Conformité aux règlements et consignes de sécurité) qui accompagne cet appareil.**

Warnung **Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.**

Avvertenza **Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.**

Advarsel **Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.**

Aviso **Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. Para ver as traduções dos avisos que constam desta publicação, consulte o documento *Regulatory Compliance and Safety Information* (Informação de Segurança e Disposições Reguladoras) que acompanha este dispositivo.**

¡Advertencia! **Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. Para ver una traducción de las advertencias que aparecen en esta publicación, consultar el documento titulado *Regulatory Compliance and Safety Information* (Información sobre seguridad y conformidad con las disposiciones reglamentarias) que se acompaña con este dispositivo.**

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the router interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a router.

- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures.

Use the following guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed board component-side-up on an antistatic surface or in a static shielding container; otherwise, immediately place it in a static shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal carrier.

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohms).

VIP4 Installation Procedures

This section includes procedures for VIP4 installation in the Cisco 7500 series or Cisco 7000 series routers, and includes information on the following topics:

- Guidelines for VIP4 Removal and Installation, page 15
- Removing a VIP4, page 18
- Installing a VIP4, page 19
- Performing a Basic Configuration, page 21

VIP4 installation is the same for each router model, except where otherwise noted.

The VIP4 is oriented horizontally in the Cisco 7010 and Cisco 7505 routers, and vertically in the Cisco 7000, Cisco 7507, Cisco 7507-MX, Cisco 7513, Cisco 7513-MX, and Cisco 7576 routers.

Each unused interface processor slots must contain an interface processor filler (an interface processor carrier without a printed circuit board) to keep dust out of the router and to maintain proper airflow through the interface processor compartment.

Note To ensure compliance with electromagnetic interference (EMI) approvals by providing a tight EMI-preventive seal for the Cisco 7500 series routers, we recommend that you first install VIP4s in the interface processor slots closest to the RSP slots, and then work out to the interface processor slots furthest from the RSP slots.

Proceed to the "Removing a VIP4" section on page 18 if you plan to replace a VIP4 with another VIP4, or if you plan to install a new VIP4, in which case you would first remove an existing interface processor or interface processor filler from an unused slot.

To install or remove a port adapter, see the "Installing or Replacing a Port Adapter on a VIP4" section on page 35.

Guidelines for VIP4 Removal and Installation

This section describes the correct procedures to avoid unnecessary board failures.

Caution The online insertion and removal (OIR) instructions should be carefully followed. Failure to insert the VIP4 properly can cause system error messages indicating a board failure. We strongly recommend that you remove or insert only one interface processor at a time. You must allow the system time to complete the initialization process before removing or inserting another interface processor. Disrupting the sequence before the system completes its verification can cause the system to detect spurious hardware failures.

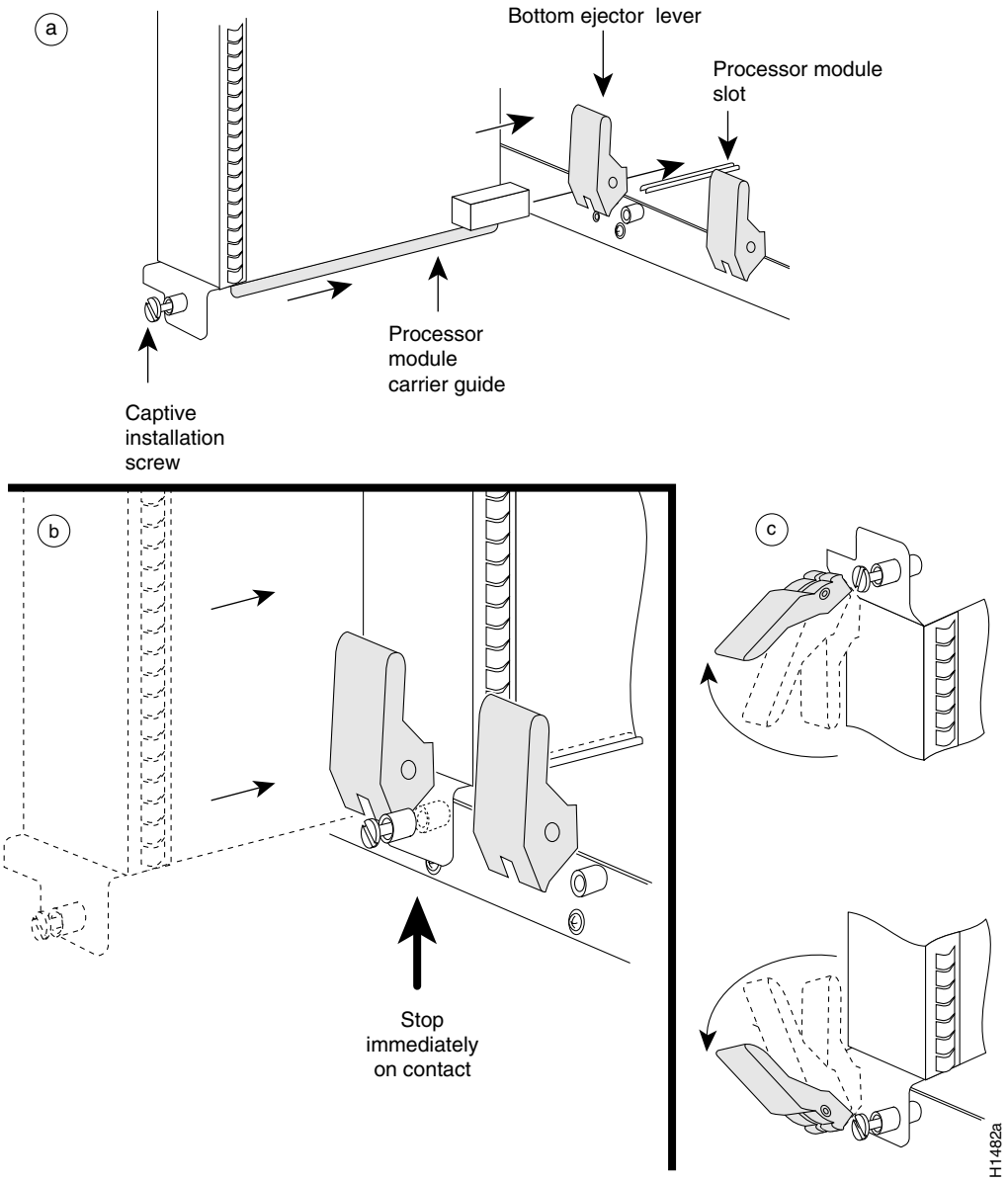
Note The VIP4 port adapters do not support OIR, so when removing or inserting a port adapter, the system must be shut down first. The VIP4 must be uninstalled before removing or installing a port adapter.

You can remove and replace interface processors (such as the VIP4) while the system is operating, with minimal disruption.When an interface processor is added or removed, the switching complex is paused while the internal data structures are rebuilt for the new interface configuration. During this time, packets are not switched through the system. However, routing adjacencies and forwarding entries are maintained throughout the insertion and removal process.

After a VIP4 is reinstalled, the system brings online only interfaces that match the current configuration and were previously configured as up; all others require that you configure them with the **configure** command. For more information on the **configure** command, refer to the documentation of the specific port adapter or interface processor that you are installing.

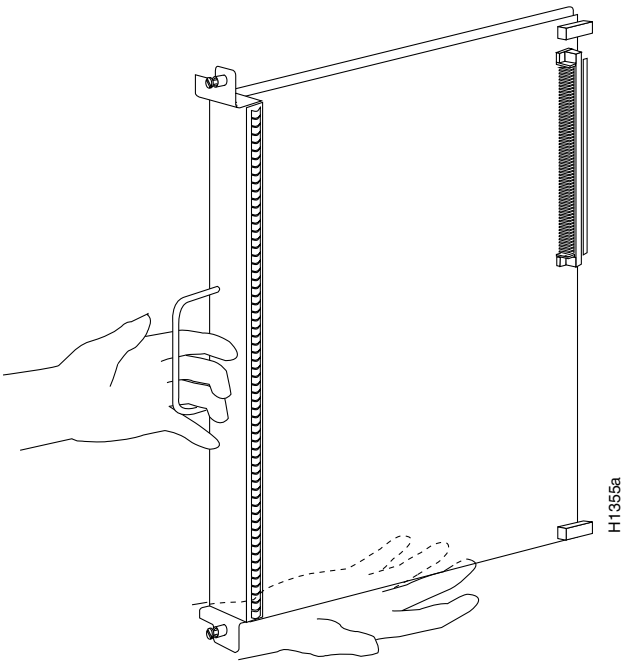
Figure 2 shows a detail of the ejector lever mechanism on the ends of the interface processor. Use the ejector levers when removing an interface processor to ensure that the backplane connector pins disconnect from the interface processor in the sequence expected by the system. Any interface processor that is only partially connected to the backplane can hang the bus.

Figure 2 Ejector Levers and Captive Installation Screws on the VIP4—Vertical Orientation Shown



Note Handle processor modules by the carrier handles and carrier edges only; never touch the board or any connector pins. (See Figure 3.)

Figure 3 Handling Interface Processors—Vertical Orientation Shown



Caution Failure to use the ejector levers and insert the interface processor properly can disrupt the order in which the pins make contact with the card or interface processor. This may cause the system to interpret a board failure.

Removing a VIP4

This section describes the procedure for removing a VIP4, an interface processor, or an interface processor filler, and replacing it with a new VIP4. Please read the "Guidelines for VIP4 Removal and Installation" section on page 15 before proceeding with this procedure.

Note To help prevent dust and contaminants from entering the chassis, do not leave the interface processor slot open. Either insert an interface processor filler in the empty slot, or proceed immediately to the "Installing a VIP4" section on page 19.

Caution In Cisco 7507, Cisco 7507-MX, Cisco 7513, or Cisco 7513-MX routers with the high system availability (HSA) or high availability (HA) feature enabled, online insertion and removal of any interface processor in either CyBus might cause the standby RSP2 to reboot with a bus error or a processor memory parity error. The active RSP recovers from this event and issues a "cBus Complex Restart" message. Systems that are configured with an RSP4 or an RSP8 as the system standby are not affected and do not experience this problem.

For more information on HSA or HA, refer to your RSP Installation and Configuration Guide.

If your router does not have the HSA or HA feature enabled, perform *only* Step 4 through Step 7 in the following procedure. If the router has the HSA or HA feature enabled with an RSP2 configured as the system standby, we recommend that you perform *all* the steps in the following procedure:

Step 1 Attach an ESD-preventive wrist strap between you and an unpainted chassis surface.

Step 2 Remove the standby RSP2.

Step 3 Wait 20 to 30 seconds. This time will vary depending on the number of interfaces installed in your system.

Step 4 Disconnect all cables from the VIP4 port adapter interface ports.

Step 5 Use a screwdriver to loosen the captive installation screws at both ends of the board. (See a in Figure 2.)

Caution Always use the ejector levers to remove a VIP4 or interface processor. Failure to do so can cause erroneous system error messages indicating a board failure.

Step 6 Place your thumbs on the ejector levers and simultaneously pull both of the ejector levers outward (in the direction shown in a of Figure 2) to release the board from the backplane connector.

- Use the board's handle to carefully pull it straight out of the slot, keeping your other hand under the carrier to guide it. (See c in Figure 3.) Keep the board parallel to the backplane.
- If you removed a VIP4 or interface processor and the interface processor slot is to remain empty, install an interface processor filler (Product Number MAS7K-BLANK=) to keep dust out of the router, maintain proper airflow inside the router, and ensure compliance with EMI approvals by providing a tight EMI-preventive seal. *Do not* leave the interface processor slot open.

Step 7 Place the removed board on an antistatic mat or foam pad, or place it in an antistatic container if you plan to return it to the factory.

Note If you do *not* have a Cisco 7507 or Cisco 7513 with the HSA or HA features enabled and an RSP2 configured as the system standby, immediately proceed to the section "Installing a VIP4"; otherwise, proceed to Step 8.

Step 8 Wait 20 to 30 seconds. This time will vary depending on the number of interfaces installed in your system.

Step 9 Reinsert the standby RSP2.

This completes the procedure for removing a VIP4 or interface processor from your Cisco 7000 series or Cisco 7500 series router. Proceed to the section "Installing a VIP4."

Installing a VIP4

This section describes the procedure for installing a VIP4. The VIP4 slides into an open interface processor slot and connects directly to the backplane. The interface processors are keyed to guide pins on the backplane, so the VIP4 can be installed only in an interface processor slot. Please read the "Guidelines for VIP4 Removal and Installation" section on page 15, if you have not already done so, before proceeding.

Note To ensure compliance with EMI approvals by providing a tight EMI seal for the Cisco 7500 and the Cisco 7000 routers, we recommend that you first install interface processors in the interface processor slots closest to the RSP slots, and then work out to the interface processor slots furthest from the RSP slots. For more information on interface processor slots on your router, refer to the *Cisco 7500 Series Installation and Configuration Guide* or the appropriate Quick Start Guide for the Cisco 7500 series routers, or refer to *Cisco 7000 Hardware Installation and Maintenance* manual for the Cisco 7000 series routers.

Figure 2 shows the functional details of inserting an interface processor and using the ejector levers. Figure 3 shows proper handling of an interface processor during installation.

Caution Remove or insert only one interface processor at a time. Allow the system to complete its discovery and initialization of the interfaces before removing or inserting another interface processor. Disrupting the sequence before the system has completed verification can cause the system to detect spurious hardware failures.

Use the following procedure to install a new VIP4:

Step 1 Attach an ESD-preventive wrist strap between you and an unpainted chassis surface.

Step 2 Ensure that a console terminal is connected to the console port (on the RSP or RSP7000) and that your console is turned on, or that you have a reliable Telnet connection to the system.

Step 3 Hold the VIP4 handle with one hand and place your other hand under the carrier to support the VIP4 and guide it into the slot. (See Figure 3.) Avoid touching the card or any connector pins.

Caution To prevent ESD damage, handle interface processors by the handles and carrier edges only.

Step 4 Place the back of the VIP4 in the slot and align the notch on the carrier with the groove in the slot. (See Figure 2.)

Step 5 While keeping the VIP4 parallel to the backplane, carefully slide it into the slot until the back of the faceplate makes contact with the ejector levers, and then *stop*. (See b in Figure 2.)

Caution Always use the ejector levers when installing or removing interface processors. An interface processor that is partially seated in the backplane might cause the system to hang and subsequently crash, and shoving or slamming the interface processor into the slot can damage the backplane pins and board.

Step 6 Using your thumbs, simultaneously push both ejector levers inward until the VIP4 is pushed entirely into its slot. (See c in Figure 2.)

Step 7 Tighten both of the captive installation screws.

Caution To ensure proper EMI isolation for the router, be sure to tighten the captive installation screws on each VIP4 immediately after you install it and *before* proceeding with the installation of each remaining VIP4 or other interface processor.

This completes the procedure for installing a VIP4 in a Cisco 7500 series or Cisco 7000 series router. (For the procedures for installing or removing a port adapter on your VIP4, see the "Installing or Replacing a Port Adapter on a VIP4" section on page 35.)

Performing a Basic Configuration

For complete descriptions of interface subcommands and the configuration options available for VIP4-related interfaces, refer to the configuration note for each of the port adapters installed on your VIP4 and to the appropriate Cisco IOS software configuration publications. (See the "Related Documentation" section on page 2.)

Checking the VIP4 Installation

This section describes the procedures you can use to verify your VIP4 installation, and includes information on the following topics:

- Verifying the VIP4 Installation, page 21
- Using show Commands to Verify the VIP4 Status, page 24
- Using show Commands to Display Interface Information, page 24
- Using the ping Command to Verify Network Connectivity, page 28

You can use the **configure** command to configure the interfaces on the port adapters installed on your VIP4. To use the **configure** command, enter the privileged level of the EXEC command interpreter with the **enable** command, as shown below. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). Use the following procedure to enter the privileged level:

Step 1 At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password, as follows:

```
Router> enable
Password:
```

Step 2 Enter the password (the password is case sensitive). For security purposes, the password is not displayed on your console.

Step 3 When you enter the correct password and press **Return**, the system displays the privileged-mode system prompt (#) as follows:

```
Router#
```

Verifying the VIP4 Installation

After you install the VIP4 and connect cables (using connection procedures in the respective subsections of the configuration notes that shipped with your port adapters), verify the installation by observing the port adapter LED states and the information displayed on your console terminal.

Note The VIP4 has no LEDs that are visible or usable when the VIP4 is installed. The port adapters you install on the VIP4 have status and interface LEDs.

When the system has reinitialized all interfaces, the enabled LED on the VIP4 port adapters and on all interface processors should go on, depending on your connections and configuration. The console screen also displays a message as the system discovers each interface during its reinitialization.

When you remove and replace interface processors, the system provides status messages on the console screen. The messages are for information only. The following sample display shows the events logged by the system as a VIP4 with a Gigabit Ethernet port adapter was removed from interface processor slot 2; the system then reinitialized the remaining interface processors and marked as *down* the Gigabit Ethernet interface on the VIP4 that was removed from slot 2. When you reinsert the VIP4, the system automatically brings up the interfaces that were up when the VIP4 was removed. (A Gigabit Ethernet interface is used in the following examples.)

Removal

```
Router#
%OIR-6-REMCARD: Card removed from slot 2, interface disabled
%LINK-5-CHANGED: Interface GigabitEthernet2/0/0, changed state to administratively down
```

Insertion

```
Router#
%OIR-6-INSCARD: Card inserted in slot 2, interface administratively shut down
%LINK-5-CHANGED: Interface GigabitEthernet2/0/0, changed state to up
```

Note When a new VIP4 is inserted or when a VIP4 is moved to a new slot, the system recognizes the new interfaces but leaves them in the *shutdown* state until you configure them and change their state to *up*.

The following sample display shows the events logged by the system as you insert a *new* VIP4 in interface processor slot 3. (A Gigabit Ethernet interface is used in the following example.)

```
Router#
%OIR-6-INSCARD: Card inserted in slot 3, interface administratively shut down
%LINK-5-CHANGED: Interface GigabitEthernet3/0/0, changed state to administratively down
```

Use the following procedure to verify that the VIP4 is installed correctly:

Step 1 While the system reinitializes each interface, observe the console display messages and verify that the system discovers the VIP4 as follows:

- If you installed a new VIP4, the system should recognize all new interfaces but leave them configured as *down*.
- If you replaced a VIP4, the system should recognize each interface and place it in the same state (*up* or *down*) each was in when you removed the VIP4.

Step 2 When the reinitialization is complete, verify that the enabled LED on each port adapter goes on and remains on. If it does, proceed to Step 5. If it does not, proceed to the next step.

Step 3 If the enabled LED on a port adapter fails to go on, suspect that the VIP4 board connector is not fully seated in the backplane. Loosen the captive installation screws, and then firmly push both ejector levers into place until they are approximately in the same orientation as the VIP4 faceplate. Tighten the captive installation screws. After the system reinitializes the interfaces, the enabled LED on the port adapter should go on. If it does, proceed to Step 5. If it does not, proceed to Step 4.

Step 4 If the enabled LED still fails to go on, remove the VIP4 and try installing it in another available interface processor slot.

- If the enabled LED goes on when the VIP4 is installed in the new interface processor slot, suspect a failed backplane port in the original interface processor slot.
- If the enabled LED still fails to go on, but other LEDs on the VIP4 port adapters go on to indicate activity, proceed to Step 5 to resume the installation checkout; suspect that the enabled LED on the port adapter has failed. Contact a service representative to report the problem and obtain further instructions.
- If no LEDs on the VIP4 port adapters go on, suspect that the VIP4 is faulty. Contact a service representative to report the problem and obtain further instructions.
- If just the enabled LED still fails to go on, remove the VIP4 and ensure the port adapter is firmly installed in their port adapter slots. Remove and reinstall them accordingly.

Step 5 If the VIP4 is new and not a replacement, you have to configure the new interfaces. Proceed to the appropriate configuration section in the configuration note that shipped with your port adapter. (This does not have to be done immediately, but new interfaces are not be available until you configure them.)

Step 6 If the VIP4 is a replacement, use the **show interfaces** *type interface-processor-slot-number/port-adapter-slot-number/interface-port-number* command or the **show controllers** command to verify the status of the interfaces. (See the following section, "Using show Commands to Verify the VIP4 Status.")

If you replaced a VIP4 with a new VIP4 with a greater number of interfaces (for example, if you replaced a VIP4 with a single port adapter with a VIP4 with two port adapters), the system recognizes the interfaces on the previously configured port adapter but does not recognize the additional port adapter interfaces. The new interfaces remain in the shutdown state until you configure them.

Step 7 When the interfaces are up, check the activity of each interface by observing the status LEDs, which are described in the appropriate LED section of your port adapter installation and configuration notes.

Step 8 In general, if an interface LED fails to go on and a cable is connected to the interface port, check the cable connection and make certain it is properly seated in the connector.

If you experience other problems that you are unable to solve, contact a service representative for assistance.

This completes the VIP4 installation. If you installed a new VIP4 or if you installed a replacement VIP4 with an additional port, you must now configure the new interface as described in the configuration note that shipped with the port adapter or in the appropriate Cisco IOS software configuration documentation listed in the section "Related Documentation" on page 2. The documentation is available on Cisco.com and the Documentation CD-ROM.

Note Port adapter configuration information is beyond the scope of this document. Please refer to the specific port adapter installation and configuration guide for more information.

Using show Commands to Verify the VIP4 Status

The following steps use **show** commands to verify that the new interfaces are configured and operating correctly.

Step 1 Use the **show version** command to display the system hardware configuration. Ensure that the list includes the new interfaces.

Step 2 Display all the current interface processors and their interfaces with the **show controllers** command. Verify that the new VIP4 appears in the correct interface processor slot.

Step 3 Specify one of the new interfaces with the **show interfaces** *type interface-processor-slot-number/port-adapter-slot-number/interface-port-number* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 4 Display the protocols configured for the entire system and specific interfaces with the **show protocols** command. If necessary, return to configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 5 Display the running configuration file with the **show running-config** command. Display the configuration stored in the RSP NVRAM using the **show startup-config** command. Verify that the configuration is accurate for the system and each interface.

If the interface is down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you still have problems bringing the interface up, contact a service representative for assistance.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Using show Commands to Display Interface Information

To display information about a specific interface, use the **show interfaces** command with the interface type and interface address in the format **show interfaces** *type interface-processor-slot-number/port-adapter-slot-number/interface-port-number.*

With the **show interfaces** command, use arguments such as the interface type and the interface address to display information about a specific interface only. The following example of the **show interfaces fastethernet** command shows information specific to a VIP4 with a Fast Ethernet port adapter (PA-2FE) installed; the VIP4 is installed in interface processor slot 1:

```
Router# show interfaces fastethernet 1/0/0
FastEthernet1/0/0 is up, line protocol is up
  Hardware is cyBus FastEthernet Interface, address is 0000.0c4c.8820 (bia 0000.0c4c.8820)
  Internet address is 192.168.36.4/28
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters 01:25:25
  Queueing strategy:fifo
```

```
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 1271000 bits/sec, 251 packets/sec
  5 minute output rate 470000 bits/sec, 83 packets/sec
     1703680 packets input, 532380667 bytes, 0 no buffer
     Received 4008 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast
     0 input packets with dribble condition detected
     566766 packets output, 260633463 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

To display hardware information about all of the interface processors in your router, including the VIP4, use the **show controllers cbus** command.

Following is an example of the **show controllers cbus** command used with a Cisco 7500 series router:

```
Router# show controllers cbus
slot1:VIP4-80 RM7000, hw 2.01, sw 22.20, ccb 5800FF30, cmdq 48000088, vps 8192
    software loaded from system
    IOS (tm) VIP Software (SVIP-DW-M), Version 12.0(16.5)S, EARLY
DEPLOYMENT MAINTENANCE INTERIM SOFTWA
    ROM Monitor version 103.0
    FastEthernet1/0/0, addr 0000.0c4c.8820 (bia 0000.0c4c.8820)
      gfreeq 48000178, lfreeq 48000208 (1536 bytes)
      rxlo 4, rxhi 287, rxcurr 3, maxrxcurr 222
      txq 48001A00, txacc 48001A02 (value 106), txlimit 110
    FastEthernet1/1/0, addr 0000.0c4c.8828 (bia 0000.0c4c.8828)
      gfreeq 48000178, lfreeq 48000210 (1536 bytes)
      rxlo 4, rxhi 287, rxcurr 0, maxrxcurr 0
      txq 48001A08, txacc 48001A0A (value 0), txlimit 110
    FastEthernet1/1/1, addr 0000.0c4c.8829 (bia 0000.0c4c.8829)
      gfreeq 48000178, lfreeq 48000218 (1536 bytes)
      rxlo 4, rxhi 287, rxcurr 3, maxrxcurr 134
      txq 48001A10, txacc 48001A12 (value 106), txlimit 110
```

To display hardware information about a specific interface on a VIP4 port adapter, append the *type* argument (**fastethernet**, **hssi**, and so forth) and the interface address argument (*interface-processor-slot-number/port-adapter-slot-number/interface-port-number)* to the **show controllers** command.

Following is an example of the syntax for this command for the interface on a PA-2FE port adapter installed in port adapter slot 0 of a VIP4 installed in interface processor slot 1 of a Cisco 7000 series or Cisco 7500 series router:

```
Router# show controllers fastethernet 1/0/0
```

To display the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images, use the **show version** (or **show hardware**) command.

Following is an example of the **show version** command used with a Cisco 7500 series router:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) RSP Software (RSP-JSV-M), Version 12.0(16.5)S, EARLY DEPLOYMENT
MAINTENANCE INTERIM SOFTWARE
TAC Support:http://www.cisco.com/cgi-bin/ibld/view.pl?i=support
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Thu 29-Mar-01 16:27 by ninahung
Image text-base:0x60010950, data-base:0x612A2000

ROM:System Bootstrap, Version 12.0(19991117:232605) [gautham-Rommon-120S
102], DEVELOPMENT SOFTWARE
BOOTFLASH:RSP Software (RSP-JSV-M), Version 12.0(16.5)S, EARLY DEPLOYMENT
MAINTENANCE INTERIM SOFTWARE

Router uptime is 2 weeks, 1 day, 19 hours, 33 minutes
System returned to ROM by reload at 20:45:17 UTC Mon Apr 2 2001
System restarted at 16:34:31 PDT Sat Apr 7 2001
System image file is "disk1:rsp-jsv-mz.120-16.5.S"

cisco RSP8 (R7000) processor with 262144K/8216K bytes of memory.
R7000 CPU at 250Mhz, Implementation 39, Rev 1.0, 256KB L2, 2048KB L3 Cache
Last reset from power-on
G.703/E1 software, Version 1.0.
G.703/JT2 software, Version 1.0.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
Bridging software.
TN3270 Emulation software.
Chassis Interface.
1 EIP controller (6 Ethernet).
1 GEIP controller (1 GigabitEthernet).
1 VIP2 controller (16 Ethernet).
4 VIP2 R5K controllers (3 FastEthernet)(24 Ethernet).
2 VIP4-80 RM7000 controllers (3 FastEthernet)(1 ATM).
46 Ethernet/IEEE 802.3 interface(s)
6 FastEthernet/IEEE 802.3 interface(s)
1 GigabitEthernet/IEEE 802.3 interface(s)
1 ATM network interface(s)
2043K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
40960K bytes of ATA PCMCIA card at slot 1 (Sector size 512 bytes).
16384K bytes of Flash internal SIMM (Sector size 256K).

Slave in slot 7 is running Cisco Internetwork Operating System Software
IOS (tm) RSP Software (RSP-DW-M), Version 12.0(16.5)S, EARLY DEPLOYMENT
MAINTENANCE INTERIM SOFTWARE
TAC Support:http://www.cisco.com/cgi-bin/ibld/view.pl?i=support
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Thu 29-Mar-01 16:30 by ninahung
Slave:Loaded from system
Slave:cisco RSP8 (R7000) processor with 262144K bytes of memory.
Configuration register is 0x2002
```

To determine specific hardware configuration information about a VIP4 installed in your system (including the amount of installed CPU and packet memory), use the **show diag** *slot* command.

Specific information is displayed, as shown in the following example of a VIP4-80 with a PA-2FE port adapter; the VIP4 is installed in interface processor slot 1:

```
Router# show diag 1
Slot 1:
        Physical slot 1, ~physical slot 0xE, logical slot 1, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status:None
        EEPROM format version 1
        VIP4-80 RM7000 controller, HW rev 2.01, board revision A0
        Serial number:14773010  Part number:73-3143-02
        Test history:0x00        RMA number:00-00-00
        Flags:cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20:01 22 02 01 00 E1 6B 12 49 0C 47 02 00 00 00 00
          0x30:50 06 00 00 00 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags:0x4      Insertion time:0x5168 (2w1d ago)

        Controller Memory Size:64 MBytes CPU SDRAM, 64 MBytes Packet
SDRAM

        PA Bay 0 Information:
                Fast-Ethernet PA, 1 ports, 100BaseTX-ISL
                EEPROM format version 1
                HW rev 1.00, Board revision A0
                Serial number:03536381  Part number:73-1688-03

        PA Bay 1 Information:
                Dual Port Fast Ethernet (RJ45), 2 ports
                EEPROM format version 4
                HW rev 1.00, Board revision 04
                Serial number:MIC043929WV  Part number:73-5419-03

        --Boot log begin--

Cisco Internetwork Operating System Software
IOS (tm) VIP Software (SVIP-DW-M), Version 12.0(16.5)S, EARLY DEPLOYMENT
MAINTENANCE INTERIM SOFTWARE
TAC Support:http://www.cisco.com/cgi-bin/ibld/view.pl?i=support
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Thu 29-Mar-01 16:33 by ninahung
Image text-base:0x60010938, data-base:0x60340000


        --Boot log end--
```

Note In the preceding command output, the line that begins with *Controller Memory Size* shows the amount of memory installed on the VIP4. If you plan a memory upgrade, make a note of these indicated memory values, then compare them after you upgrade memory to verify the upgrade.

Using the ping Command to Verify Network Connectivity

This section provides brief descriptions of the **ping** command. The **ping** command allows you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. After you verify that the system and VIP4 have booted successfully and are operational, you can use this command to verify the status of the VIP4 interface ports. Refer to the publications listed in the "Related Documentation" section on page 2 for detailed command descriptions and examples.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the IP address 10.1.1.60:

```
Router# ping 10.1.1.60 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.1.1.60, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the server and that the server is active (powered on), and repeat the **ping** command.

For complete descriptions of interface subcommands and the configuration options available for VIP4-related interfaces, and which commands support VIP4 functionality, refer to the publications listed in the "Related Documentation" section on page 2.

VIP4 Maintenance Procedures

The following sections discuss maintenance procedures you might need for your VIP4 and port adapters:

- Upgrading VIP4 Microcode, page 28
- Upgrading VIP4 Memory, page 31
- Checking the VIP4 Memory Upgrade, page 35
- Installing or Replacing a Port Adapter on a VIP4, page 35

Upgrading VIP4 Microcode

The Cisco 7000 series and Cisco 7500 series routers support downloadable microcode, which enables you to upgrade microcode versions over the network. You can download new microcode versions and store multiple versions in Flash memory, and you can then boot from them just as you can with the system software images. System software upgrades might also contain upgraded microcode images, which will load automatically when the new software image is loaded (unless the configuration states otherwise).

Note Software and interface processor microcode images are carefully optimized and bundled to work together. Overriding the Cisco IOS software bundle can result in system incompatibilities. We recommend that you use the microcode included in the Cisco IOS software bundle.

You can download microcode to Flash memory by copying the TFTP image of a microcode version to Flash memory. When the microcode image is stored in Flash memory, you have to configure the router to use that image using the **microcode vip4 flash** command; then you can use the **microcode reload** command to manually load the new microcode file. Finally, you use the **configure** command to instruct the system to load the new image automatically at each system boot.

Note The appropriate microcode image runs from DRAM (or SDRAM) on the VIP4.

To compare the size of the microcode image and the amount of Flash memory available, you must know the size of the new microcode image. The image size is specified in the README file that is included with the new image.

Note Note the size of the new image before proceeding to ensure that you have sufficient available Flash memory for the new image.

Caution Before you copy a file to system Flash memory, be sure there is ample space available in Flash memory. Compare the size of the file you want to copy to the amount of available Flash memory shown. If the space available is less than the space required by the file you want to copy, the copy process will continue, but the entire file will not be copied into Flash memory.

Use the following procedure to download (copy) a microcode version from a TFTP server to Flash memory:

Step 1 To display the total amount of Flash memory present, its location, any files that currently exist in Flash memory and their size, and the amount of Flash memory remaining, use the **show flash** command. Following is an example of the output that is displayed:

```
Router# show flash

-#- ED --type-- --crc--- -seek-- nlen -length- -----date/time------ name
1   .. image    0A423F1B  E01200   22 14553472 Apr 18 2001 19:19:16 rsp-jsv-mz_n

6024704 bytes available (14553600 bytes used)
```

Step 2 Compare the amount of available Flash memory (last line in the preceding example) to the size of the new microcode image on the floppy disk. If you attempt to copy in a new image, and the size of the new image exceeds the available space in Flash memory, only part of the new image will be copied, and the following error message will be displayed:

```
buffer overflow - xxxx/xxxx
```

In this error message, *xxxx/xxxx* is the number of bytes read in/number of bytes available.

Step 3 After you verify that there is sufficient space available in Flash memory for the new image, use the command **copy tftp:***filename* [**flash | slot0 | slot1**]:*filename* to copy an image to Flash memory. (The file source is **tftp:***filename,* and [**flash | slot0 | slot1**]:*filename* is the destination in onboard Flash memory or on either of the Flash memory cards.)

An example of the **copy tftp:***filename* command follows:

```
Router# copy tftp:vip11-1 slot0:vip11-1
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet1/0): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

Immediately after you enter the **microcode reload** command and press **Return**, the system reloads all microcode. Configuration mode remains enabled; after the reload is complete, press **Ctrl-Z** to exit configuration mode and return to the system prompt.

Step 10 To verify that the VIP4 is using the correct microcode, issue the **show startup-config** or **show controllers cbus** command, which indicates the currently loaded and running microcode version for each interface processor.

```
Router# show controllers cbus
```

This completes the procedure for downloading microcode to Flash memory.

Upgrading VIP4 Memory

This section provides the guidelines and procedures for upgrading CPU memory (also called *program memory*).

To upgrade CPU memory on your VIP4, you must replace the SDRAM DIMM located in socket U1. Be sure that you locate the correct socket, because you should not upgrade the SDRAM DIMM for packet memory that is located in socket U5. See Figure 4. The default memory configurations for the VIP4 are 64 MB of CPU memory and 64 MB of packet memory.

Note You can upgrade CPU memory to 256 MB but you *should not upgrade the packet memory from the standard 64 MB*.

Note In the output display of the **show diag** command (see page 26), the line that begins with *Controller Memory Size* shows the amount of memory installed on the VIP4. Make a note of these memory values, then compare them after you upgrade memory to verify the upgrade.

The following Cisco Systems memory spare and upgrade kits are compatible with the VIP4:

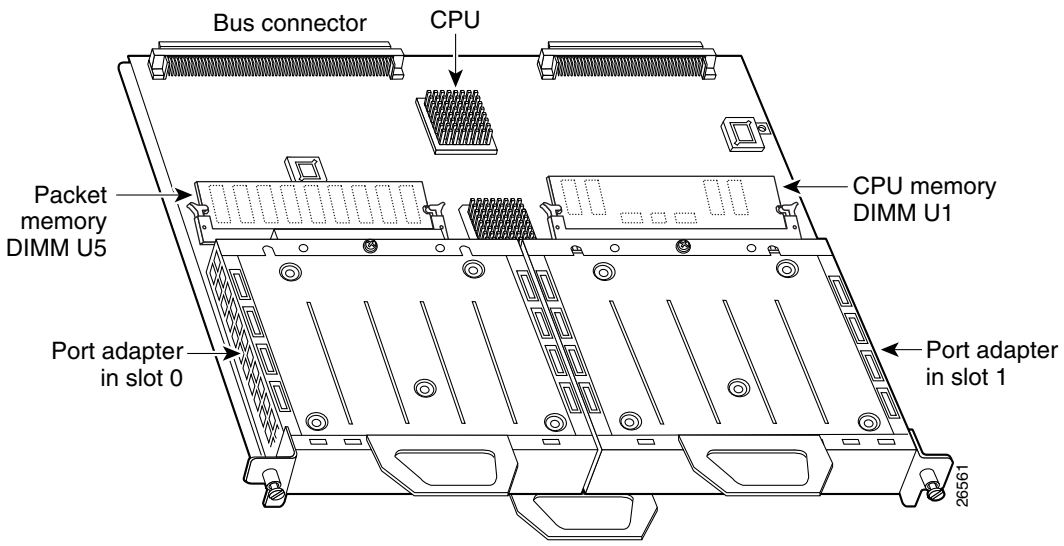
Table 8 Memory Spare and Upgrade Kit

Product	Description
MEM-VIP4-64M-SD=	Memory spare option for VIP4 CPU memory or packet memory
MEM-VIP4-128M-SD=	Upgrades VIP4 CPU memoryfrom 64 to 128 MB, with one 128-MB SDRAM DIMM (This 128-MB memory option is for CPU memory only.)
MEM-VIP4-256M-SD=	Upgrades VIP4 CPU memory from 64 to 256 MB, or from 128 MB to 256 MB, with one 256-MB SDRAM DIMM (This 256-MB memory option is for CPU memory only.)

Depending on your system configuration, a memory upgrade might be required. Also, if a system problem is determined to be caused by a DIMM, a DIMM replacement might be required.

Figure 4 shows the locations of the CPU memory and packet memory SDRAM DIMMs on the VIP4.

Figure 4 Location of CPU Memory and Packet Memory DIMMs on the VIP4



Caution To prevent ESD damage, handle DIMMs by the card edges only. Place removed DIMMs on an antistatic mat and store them in an antistatic bag.

Note Use only SDRAM DIMMs from Cisco Systems. A Cisco manufacturing part number appears on each SDRAM DIMM.

Removing SDRAM DIMMs

Use the following procedure to remove the existing DIMMs:

Step 1 Turn off the system power and remove the VIP4 from the system. (Follow the steps in the "Removing a VIP4" section on page 18.)

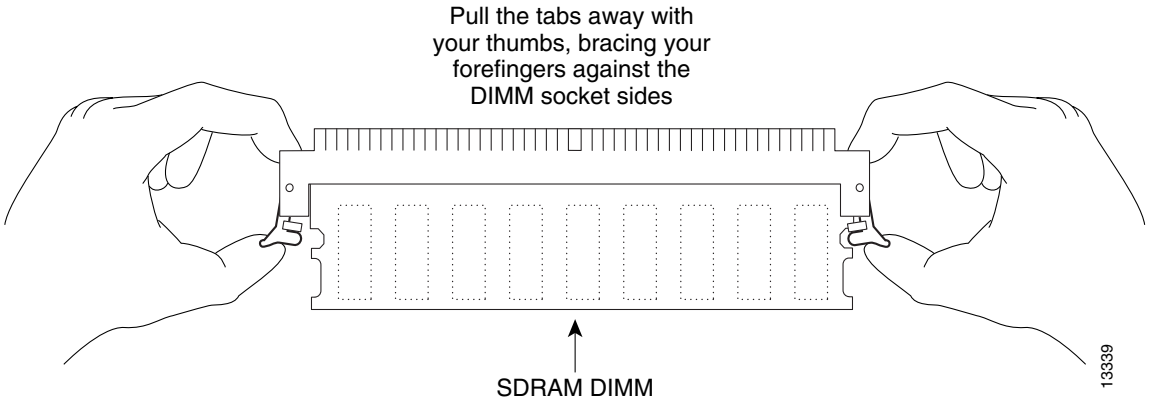
Step 2 Place the VIP4 on an antistatic mat or pad and ensure that you are wearing an antistatic device, such as a wrist strap.

Position the VIP4 so that the handles are away from you and the bus connectors are toward you—opposite of the position shown in Figure 4.

Step 3 Locate the DIMM and position the VIP4 so that you are facing the DIMM module you want to remove.

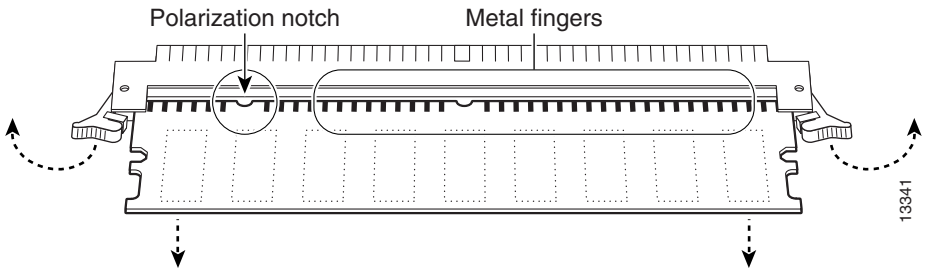
Step 4 Open the DIMM socket tabs on the DIMM to release the DIMM from the socket. (See Figure 5.) The DIMM is under tension in the socket; therefore, the DIMM might be released from the socket with some force.

Figure 5 Opening the DIMM Socket Tabs



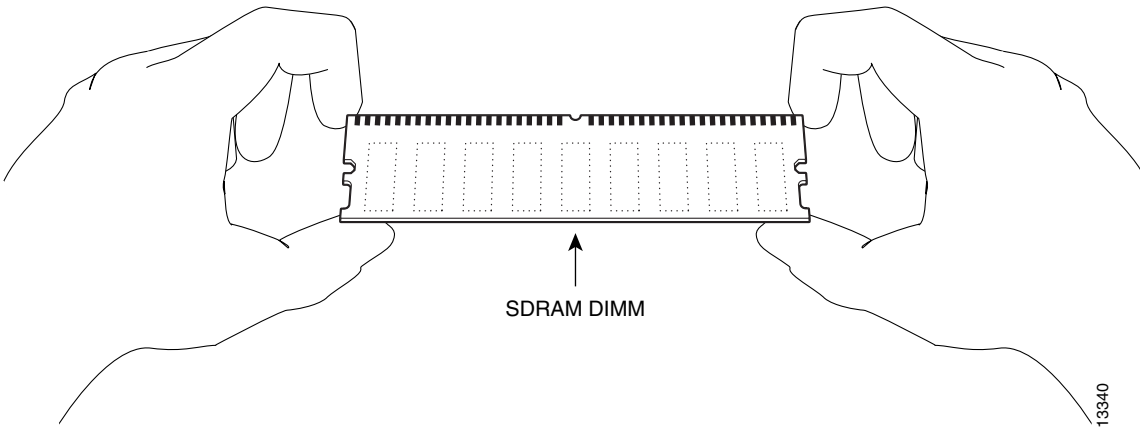
Step 5 With the DIMM socket tabs open, grasp the ends of the DIMM between your thumbs and forefingers and pull the DIMM completely out of the socket. (See Figure 6.)

Figure 6 Removing the DIMM



Note Handle the edges of the DIMM only; avoid touching the memory module, pins, or traces (the metal *fingers* along the connector edge of the DIMM). (See Figure 7.)

Figure 7 Handling the DIMM



Caution To prevent ESD damage when working with DIMMs: handle the DIMM by the card edges only, place a removed DIMM on an antistatic mat, and store it in an antistatic container.

Step 6 Place the DIMM in an antistatic container to protect it from ESD damage.

This completes the DIMM removal procedure.

Installing SDRAM DIMMs

Caution The DIMM is a sensitive component that is susceptible to ESD damage. Handle the DIMM by the edges only; avoid touching the memory modules, pins, or traces (the metal *fingers* along the connector edge of the DIMM). To prevent ESD damage, handle the DIMM as shown in Figure 7.

With the VIP4 in the same orientation as the previous procedure (with the handle away from you and the bus connector toward you), use the following procedure to install the new DIMM in the DIMM socket:

Step 1 Remove the new DIMM from its antistatic container.

Step 2 Hold the DIMM between your thumbs and forefingers. (See Figure 7.)

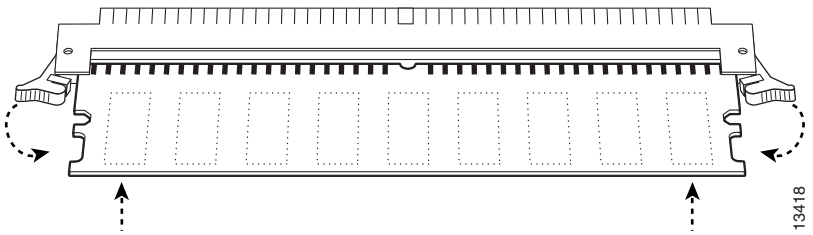
Note The 64-MB DIMM should be facing component-side down.

Step 3 Insert the connector edge of the DIMM straight into the socket.

Caution When inserting the DIMM, use firm but not excessive pressure. If you damage a socket, you will have to return the VIP4 to the factory for repair.

Step 4 Gently push the DIMM into the socket until the socket tabs close over the ends of the DIMM. (See Figure 8.) If necessary, rock the DIMM gently back and forth to seat it properly.

Figure 8 Inserting the DIMM



Step 5 When the DIMM is installed, check to see it is seated properly. If the DIMM appears misaligned, carefully remove it and reseat it in the socket. Push the DIMM firmly back into the socket until first one and then the other socket tab moves into place.

Step 6 If you have a network processing engine with more than one DIMM socket and are replacing the second DIMM also, repeat steps Step 1 through Step 5 above.

This completes the DIMM replacement procedure. Reinstall the VIP4 in the system. (Follow the steps in the "Installing a VIP4" section on page 19.) See the following section, "Checking the VIP4 Memory Upgrade," as required.

Checking the VIP4 Memory Upgrade

After you upgrade the VIP4 memory, verify the memory upgrade:

- Observe the LED states and the console display. When the system has reinitialized all interfaces, the enabled LEDs on the VIP4 port adapters should go on. (Port adapter status LEDs might be on, depending on your connections.) The console screen also displays a message as the system discovers each interface during its reinitialization.
- Use the **show diag** command to verify that the system recognizes the new memory; check the line of the **show diag** command output that begins with *Controller Memory Size*.

If, after you have replaced memory devices, the system fails to boot properly, if the console terminal displays a checksum or memory error, or if the **show diag** command output indicates an incorrect amount of memory (or no memory), check the following:

- Ensure that all memory devices are installed correctly. If necessary, shut down the system and remove the VIP4. Check the memory devices by looking straight down on them and then at eye level. The devices should be aligned at the same angle and the same height when properly installed. If a memory device appears to stick out or rest in the socket at a different angle from the others, remove the device and reinsert it; then replace the VIP4 and reboot the system for another installation check.
- Each DIMM socket must contain a DIMM of the correct size and speed or the system cannot operate. To ensure this, use only memory devices that are included with Cisco Systems memory kits.
- See the "Checking the VIP4 Installation" section on page 21.

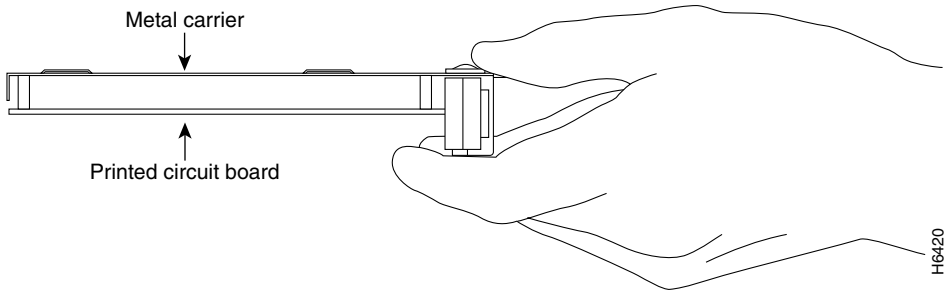
If after several attempts the system fails to restart properly, contact a service representative for assistance. Before you call, make note of any error messages, unusual LED states, or any other indications that might help solve the problem.

This completes the VIP4 memory upgrade.

Installing or Replacing a Port Adapter on a VIP4

Depending on the circumstances, you might need to install a new single-width or dual-width port adapter on a VIP4 motherboard or replace a failed port adapter in the field. In either case, you need a number 1 Phillips screwdriver, an antistatic mat onto which you can place the removed VIP4, and an antistatic container into which you can place a failed port adapter for shipment back to the factory. Always handle the port adapter by the carrier edges and handle; never touch the port adapter components or connector pins. (See Figure 9.)

Figure 9 Handling a Port Adapter



Caution To prevent system problems, do not remove port adapters from the VIP4 motherboard or attempt to install other port adapters on the VIP4 motherboard *while the system is operating*. To install or replace port adapters, first remove the VIP4.

Warning **When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.**

To replace a port adapter, use the procedure that is appropriate to your port adapter type:

- Single-Width Port Adapter, page 36—For replacing a single-width port adapter on your VIP4
- Dual-Width Port Adapter, page 37—For replacing a dual-width port adapter on your VIP4

Single-Width Port Adapter

Single-width port adapters occupy one of the two port adapter slots on a VIP4. When a single-width port adapter slot is not in use, a blank port adapter must fill the empty slot to allow the router to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow through the router. If you plan to install a new single-width port adapter in a port adapter slot that is not in use, you must first remove the blank port adapter.

Figure 10 describes the steps required to install a single-width port adapter.

Figure 10 Removing and Installing a Single-Width Port Adapter

Note: You must first remove the VIP from the chassis before removing a port adapter from the VIP4.

Step 1
To remove the port adapter, remove
the screw that secures the port adapter (or blank port adapter). (See A.)

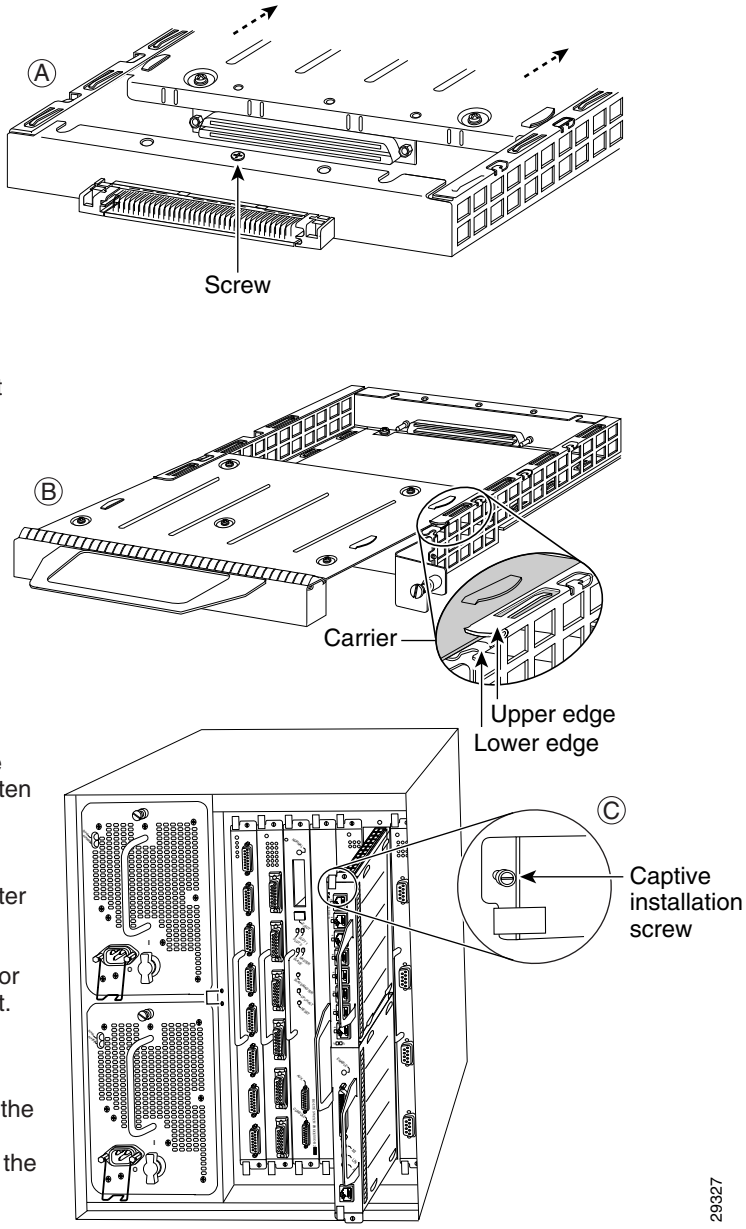
Step 2
With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See A.)

Step 3
To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot. (See B.)

Step 4
Install the screw in the rear of the port adapter slot. Do not overtighten the screw. (See A.)

Step 5
Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

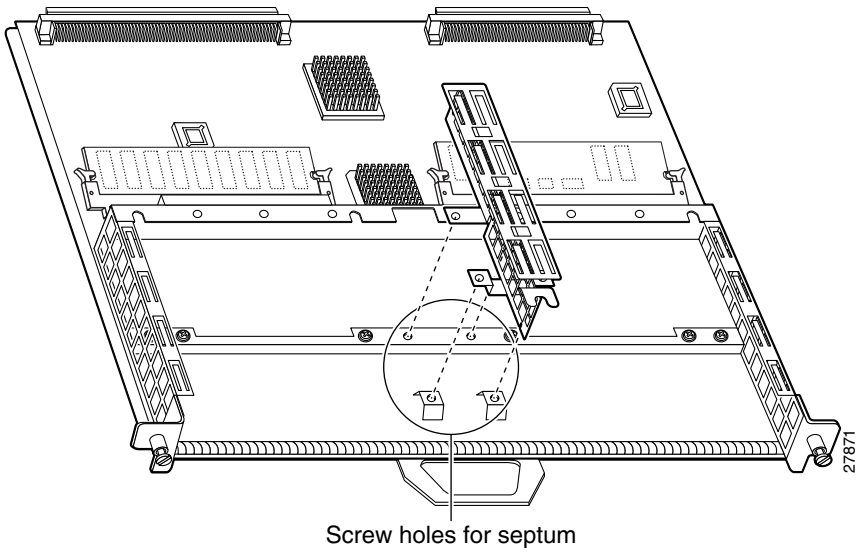
Step 6
Reinstall the VIP motherboard in the chassis, and tighten the captive installation screw on each end of the VIP faceplate. (See C.)



Dual-Width Port Adapter

Dual-width port adapters occupy both port adapter slots on a VIP4. Before you can install a dual-width port adapter, you must first remove the slot divider that is located between the two port adapter slots. (See Figure 11.) Refer to Table 5 for a list of dual-width port adapters.

Figure 11 Location of VIP4 Slot Divider and Screws



Use the following procedure to remove the slot divider from a VIP4:

Step 1 Attach an ESD-preventive wrist strap between you and an unpainted chassis surface.

Step 2 Remove the VIP4 from the router. (See the "Removing a VIP4" section on page 18.)

Step 3 Place the removed VIP4 on an antistatic mat or foam pad.

Step 4 Remove any installed port adapters or blank port adapters from the port adapter slots on the VIP4. To do this, use a number 1 Phillips screwdriver to remove the screw located at the rear of each port adapter slot.

- To locate this screw on single-width port adapters, see the first panel of Figure 10.
- To locate this screw on dual-width port adapters, see the first panel of Figure 12.

Step 5 Use a number 1 Phillips screwdriver to remove the four slot divider screws that secure the slot divider to the VIP4 motherboard. (See Figure 11.)

Step 6 Remove the slot divider and store it (and the screws) in a location where you can retrieve it for use later.

Note If you need to reinstall the port adapter slot divider, place the slot divider in position on the VIP4 and secure it with the four Phillips screws.

With the slot divider removed, see Figure 12, which describes the steps required to install or remove a dual-width port adapter.

Figure 12 Removing and Installing a Dual-Width Port Adapter

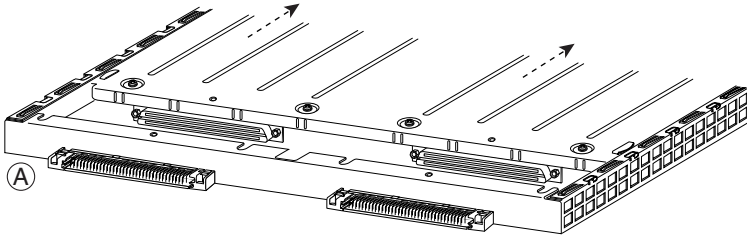
Note: You must first remove the VIP from the chassis before removing the dual-width port adapter from the VIP.

Step 1

To remove the port adapter, remove the screws that secure the port adapter to the VIP.

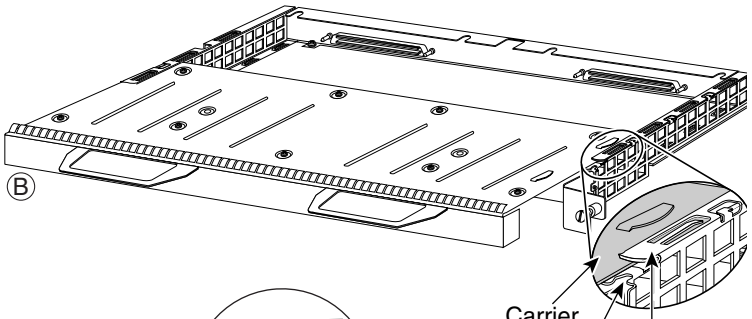
Step 2

With the screws removed, grasp the handles on the front of the port adapter and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See A.)



Step 3

To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot on the VIP. (See B.) Carefully slide the port adapter into the port adapter slot until the connectors at the rear of the port adapter are completely seated in the connectors at the rear of the port adapter slot.

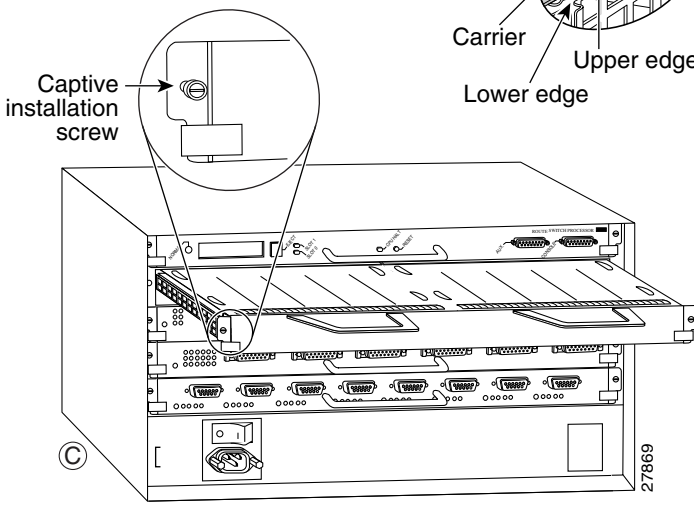


Step 4

Install the screws in the rear of the port adapter slot. Do not overtighten the screws.

Step 5

Carefully slide the VIP into the interface processor slot until the connectors at the rear of the VIP are completely seated in the connectors at the rear of the interface processor slot. Use the ejector levers to seat the VIP in the interface processor slot. Tighten the captive installation screws on the VIP. (See C.)



VIP4 Troubleshooting

To troubleshoot the VIP4, refer to Troubleshooting VIP Crashes online at http://www.cisco.com/warp/customer/63/vip_crash.html which requires user registration to access. To become a registered user, refer to http://www.cisco.com/register/.

Listed below are common sense guidelines to troubleshoot the router, the VIP4 and its memory components, and the port adapter installation:

- Verify that the router is plugged in.
- Visually inspect the routers, the port adapters, and the VIP4 and its components to confirm that they appear to be in working order. Check to see that the LEDs are lighting up.
- Remove and reinstall the VIP4 to reseat it. See instructions in the "Removing a VIP4" section on page 18.
- If you replaced the SDRAM DIMMs, remove and reinstall them, to reseat them. See the "Upgrading VIP4 Memory" section on page 31.
- Remove and reinstall the port adapters. See the "Installing or Replacing a Port Adapter on a VIP4" section on page 35.

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at the following sites:

- http://www.cisco.com
- http://www-china.cisco.com
- http://www-europe.cisco.com

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or as an annual subscription.

Ordering Documentation

Cisco documentation is available in the following ways:

- Registered Cisco Direct Customers can order Cisco Product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/cgi-bin/order/order_root.pl

- Registered Cisco.com users can order the Documentation CD-ROM through the online Subscription Store:

  http://www.cisco.com/go/subscription

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco corporate headquarters (California, USA) at 408 526-7208 or, in North America, by calling 800 553-NETS (6387).

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If you are reading Cisco product documentation on the World Wide Web, you can submit technical comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco.

You can e-mail your comments to bug-doc@cisco.com.

To submit your comments by mail, for your convenience many documents contain a response card behind the front cover. Otherwise, you can mail your comments to the following address:

Cisco Systems, Inc.
Document Resource Connection
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools. For Cisco.com registered users, additional troubleshooting tools are available from the TAC website.

Cisco.com

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Customers and partners can self-register on Cisco.com to obtain additional personalized information and services. Registered users can order products, check on the status of an order, access technical support, and view benefits specific to their relationships with Cisco.

To access Cisco.com, go to the following website:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

Contacting TAC by Telephone

If you have a priority level 1 (P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

This document is to be used in conjunction with the documents listed in the "Related Documentation" section on page 2 section.

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